

**What is claimed is:**

1. An improved apparatus for ground support rotatable by rotation means, said improved apparatus adapted for insertion into a drilled hole penetrating a rock face, the improved apparatus comprising:

- a. a tensionable reinforcing member comprising:

- i. a longitudinal axis;
- ii. a diameter;
- iii. a first end threaded portion having a free end and a first length wherein said first end threaded portion extends out of said drilled hole;
- iv. a second end ribbed portion having a second length wherein said second length of said second end ribbed portion is adapted for total placement within the drilled hole;
- v. at least one first bore, wherein said at least one first bore has a diameter and an inside surface, and wherein the at least one first bore is positionable intermediate of the first length of the first end threaded portion, and wherein the at least one first bore tranverses the diameter of the first end threaded portion, and further wherein the at least one first bore is perpendicular to said longitudinal axis;

- b. at least one nut threadably receivable by the tensionable reinforcing member first end threaded portion, said at least one nut having a body, said body comprising:
  - i. a squared portion having an axis, a first axial length, and a first width;
  - ii. an convex hemispherical portion, adjacent to, coaxial with and integral to said squared body portion;
  - iii. a second bore having a diameter, wherein said second bore extends co-axially through the squared portion and said hemispherical portion of the at least one nut body said second bore adapted for threaded engagement with the first end threaded portion of the tensionable reinforcing member;
- c. at least one third bore having a diameter equal to the diameter of the at least one first bore and an inside surface, said at least one third bore tranversing the squared portion of the at least one nut body, the at least one third bore positioned intermediate of the axial length of the squared portion of the at least one nut body, wherein the at least one third bore and the at least one first bore have identical diameters, and further wherein the at least one third bore and the at least one first bore are axially alignable when the at least one nut body is engaged with

the first end threaded portion of the tensionable reinforcing member,  
and,

- d. at least one shearing element capable of shearing at a predetermined torque<sub>shear</sub>, said at least one shearing element placed within the axially aligned at least one first bore and at least one third bore thereby temporarily fixing the at least one nut adjacent to said free end of the first end threaded portion of the tensionable reinforcing member.

- 2. The improved apparatus of claim 1 wherein the nut is molded from suitable strong materials.
- 3. The improved apparatus as claimed in claim 2 where in the at least one nut body includes a circumferential shoulder between the squared portion of the at least one nut and the convex hemispherical portion of the at least one nut, said circumferential shoulder adapted to abut against said rotation means.
- 4. The apparatus as claimed in claim 3, further comprising at least one bearing plate having a central domed portion and a circular aperture positioned centrally within said central domed portion, said at least one bearing plate adapted for placement upon the first end threaded portion of the tensionable reinforcing member, the at least one bearing plate positionable between said rock face and the at least one nut convex hemispherical portion, wherein said

central domed portion is adjacent to and in confronting relation to the at least one nut convex hemispherical portion, and wherein the central domed portion circular aperture is adapted for pivoting engagement with the convex hemispherical portion of the at least one nut.

5. The improved apparatus of claim 4, wherein the squared portion of the at least one nut body is sufficiently dimensioned so that the at least one third bore does not degrade the strength of the at least one nut body.
6. The improved apparatus of claim 5 wherein the at least one nut has a first pre-torque<sub>shear</sub> temporary operation position adjacent to the free end of the first end threaded portion of the tensionable reinforcing member.
7. The improved apparatus of claim 6 wherein the at least one nut has a second post-torque<sub>shear</sub> operating position located adjacent to the rock face.
8. The improved apparatus of claim 7 wherein the at least one nut has a third torque<sub>max</sub> position located adjacent to the rock face and adapted for the transmission of tensile forces into the tensionable reinforcing member.
9. The improved apparatus of claim 8 wherein the rotation means engages the at least one nut in its first pre-torque<sub>shear</sub> temporary operation position, and wherein the rotation means applies torque<sub>shear</sub> to the nut thereby failing the

shearing element, thereby permitting the nut to advance from its first pre-torque<sub>shear</sub> temporary operation position to its second post-torque<sub>shear</sub> permanent operation position.

10. The improved apparatus as claimed in claim 9 wherein the shearing element is a rolled spring member manufactured from carbon steel.

11. The improved apparatus as claimed in claim 10 wherein said rolled spring member has a variable diameter, and wherein the rolled spring member has:

- a. a first unbiased state having a first unbiased state diameter, wherein said first unbiased diameter is larger than the diameter of the aligned at least one first bore and the at least one third bore;
- b. a second fully biased state having a second fully biased state diameter, wherein said second fully biased state diameter is smaller than the diameter of the aligned at least one first bore and the at least one third bore, so that the rolled spring member can be inserted completely into the aligned at least one first bore and the at least one third bore; and,
- c. a third partially biased state having a third partially biased state diameter, wherein said third partially biased state diameter expands to fill the aligned at least one first bore and at least one third bore, and

further wherein the rolled spring member exerts a biasing force against the inside surface of the aligned at least one first bore and the at least one third bore.

12. The improved apparatus as claimed in claim 11, wherein the rolled spring member is manufactured from material having sufficient strength to resist shear forces less than  $\text{torque}_{\text{shear}}$ , and further wherein the rolled spring member fails consistently at a predetermined  $\text{torque}_{\text{shear}}$ .
13. The improved apparatus as claimed in claim 12 wherein the rolled spring member is able to consistently shear at a predetermined  $\text{torque}_{\text{shear}}$  without fracturing and creating hazardous shards that could injure workers.
14. The improved apparatus as claimed in claim 13 wherein, post- $\text{torque}_{\text{shear}}$ , the remnants of the rolled spring member remain within their respective at least one first bore and at least one third bore.
15. In an improved apparatus for ground support comprising a tensionable reinforcing member having a diameter, first end threaded portion and an at least one first bore transversing said diameter of said first end threaded portion;

- a. an at least one nut threadably receivable by said tensionable reinforcing member first end threaded portion, said at least one nut having a body, said body comprising:
- i. an squared portion having an axis, a first axial length, and a first width;
  - ii. an convex hemispherical portion, adjacent to, coaxial with and integral to said squared body portion;
  - iii. a second bore extending co-axially through the squared portion and said convex hemispherical portion of the at least one nut body said second bore adapted for threaded engagement with the first end threaded portion of the tensionable reinforcing member;
- b. at least one third bore transversing the squared portion of the at least one nut body, said at least one third bore positioned intermediate of the axial length of the squared portion of the at least one nut body, wherein the at least one third bore and the at least one first bore have identical diameters, and further wherein the at least one third bore and the at least one first bore are axially alignable when the at least one nut body is engaged with the first end threaded portion of the transferable reinforcing member, and,

- c. at least one shearing element capable of shearing at a predetermined torque<sub>shear</sub>, said at least one shearing element placed within the axially aligned at least one first bore and at least one third bore thereby fixing the at least one nut adjacent to said free end of the first end threaded portion of the tensionable reinforcing member.

16. The at least one nut as claimed in claim 15, wherein said at least one shearing element is a rolled steel spring member made from carbon steel, wherein said rolled steel spring member is adapted to fail consistently at a predetermined torque<sub>shear</sub>.

17. In an improved apparatus for ground support comprising a tensionable reinforcing member having a diameter, first end threaded portion and an at least one first bore transversing said diameter of said first end threaded portion;

- a. an at least one nut threadably receivable by said tensionable reinforcing member first end threaded portion, said at least one nut having a body, said body comprising:
  - i. an squared portion having an axis, a first axial length, and a first width;
  - ii. an convex hemispherical portion, adjacent to, coaxial with and integral to said squared body portion;



- iii. a second bore extending co-axially through the squared portion and said convex hemispherical portion of the at least one nut body said second bore adapted for threaded engagement with the first end threaded portion of the tensionable reinforcing member;
- b. at least one third bore transversing the squared portion of the at least one nut body, said at least one third bore positioned intermediate of the axial length of the squared portion of the at least one nut body, wherein the at least one third bore and the at least one first bore have identical diameters, and further wherein the at least one third bore and the at least one first bore are axially alignable when the at least one nut body is engaged with the first end threaded portion of the transferable reinforcing member, and,
- c. at least one shearing element capable of shearing at a predetermined torque<sub>shear</sub>, said at least one shearing element placed within the axially aligned at least one first bore and at least one third bore thereby fixing the at least one nut adjacent to said free end of the first end threaded portion of the tensionable reinforcing member; and,
- d. at least one bearing plate having a central domed portion and a circular aperture positioned centrally within said central domed portion, said at

least one bearing plate adapted for placement upon the first end threaded portion of the tensionable reinforcing member, the at least one bearing plate positionable between said rock face and the at least one nut convex hemispherical portion, wherein said central domed portion is adjacent to and in confronting relation to the at least one nut convex hemispherical portion, and wherein the central domed portion circular aperture is adapted for pivoting engagement with the convex hemispherical portion of the at least one nut.

18. The at least one nut as claimed in claim 17, wherein said at least one shearing element is a rolled steel spring member made from carbon steel, wherein said rolled steel spring member is adapted to fail consistently at a predetermined torque<sub>shear</sub>.